CNMOC-NAVO-NPS Thesis Program for ASW/MIW

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Monterey, California : Naval Postgraduate School

http://hdl.handle.net/10945/27347

CNMOC-NAVO-NPS Thesis Program for ASW/MIW

Peter C Chu

Department of Oceanography
Naval Postgraduate School

Vision

- **(1) Academic Achievements and Military Relevance.**
- **(2) World class theses in Littoral ASW/MIW Oceanography that provides effective and usable synthetic environments for operations, analysis, acquisition and education/training.**
- **(3) Well Preparation of the METOC Officers for Future Assignments.**

Multi-Agent Support

- **CNO-N6M**
- **CNMOC, NAVO**
- **ONR**
- **SPAWAR**

Partnership

- NPS: Peter Chu and Students
- CNMOC: CAPT James Berdeguez, CDR Robert Witzleb
- NAVO: Ron Betsch, Peter Fleischer, Steve Haeger
- ONR-Global: CDR Eric Gottshall
- NUWC: David Cwalina
- NRL-Stennis: Phil Valent, Mike Richardson, Paul Elmore, Dan N. Fox, Charlie Barron, …
- Ruth E. Keenan (SAIC)

Selected CNMOC-NAVO-NPS Theses (1)

- Fralick, Charles., "Yellow Sea thermal structure," MS in Physical Oceanography, September 1994 [Co-advised by Steve Haeger (NAVO)].

- Wells, Susan K., "Temporal and spatial decorrelation scales of the Yellow Sea thermal fields," MS in Physical Oceanography, September 1994 [Co-advised by Michael Carron (NAVO)].

- Tseng, Hsing-Chia, "South China Sea warm-core and cold-core eddies detected from the Navy's Master Oceanographic Observation Data Set (MOODS) ," MS in Physical Oceanography, September 1995 [Co-advised by Steve Haeger (NAVO)].

- Edmons, Nate, "South China Sea ocean circulations simulated by a primitive equation model," MS in Physical Oceanography, September 1996 [Co-advised by Steve Haeger (NAVO)].

- Gottshall, Eric, "Environmental Effects on Naval warfare simulations," MS in Physical Oceanography, December 1997.

Selected CNMOC-NAVO-NPS Theses (2)

- Veneziano, Joseph, "Hurricane Effects on the South China Sea Thermal Structure" MS in Physical Oceanography, March 1998 [Co-advised by Steve Haeger (NAVO)].

- Taber, Victoria L., "Environmental Sensitivity Studies on Mine Impact Burial Prediction Model" MS in Meteorology and Oceanography, March 1999 [Co-advised by Steve Haeger (NAVO)].

- Strauhs, Hilbert, "A Numerical Study on Japan/East Sea (JES) Circulation and Thermohaline Structure" MS in Meteorology and Oceanography, September 1999 [Co-advised by Michael Carron (NAVO)].

- Smith, Timothy, "Validation of the Mine Impact Burial Model Using Experiment Data". MS in Meteorology and Oceanography, September 2000 [Co-advised by Steve Haeger (NAVO)].

- Cintron, Carlos, "Environmental Impact on Mine Hunting in the Yellow Using the CASS-GRAB Model". MS in Physical Oceanography, March 2001 [Co-advised by Steve Haeger (NAVO)].

Selected CNMOC-NAVO-NPS Theses (3)

- Michael J. Roth, "A coastal air-ocean coupled system (COAMPS) for east Asian marginal sea prediction". MS in Meteorology and Oceanography, September 2001 [Co-advised by Steve Haeger (NAVO)].

- Anthony Gilles, "Mine Drop Experiments". MS in Meteorology and Oceanography, September 2001 [Co-advised by Steve Haeger (NAVO)].

- Nick Vares, "Mine Hunting and Detection Using the Navy's CASS-GRAB Model". MS in Physical Oceanography, June 2002 [Co-advised by Steve Haeger (NAVO)].

- Ashely Evans, "Hydrodynamics of Mine Impact Burial". MS in Meteorology and Oceanography, September 2002 [Co-advised by Peter Fleischer (NAVO)].

- Rodrigo Obino, "Simulation of the Bohai Sea Circulation and Thermohaline Structure". MS in Physical Oceanography, June 2002 [Co-advised by Steve Haeger (NAVO)].

Selected CNMOC-NAVO-NPS Theses (4)

- Ahchuang Ong, "Diagnostic Initialization of the South China Sea Prediction". MS in Physical Oceanography, March 2003 [Co-advised by Steve Haeger (NAVO)].

- Michael Perry, "Value-Added of Satellite Altimetry Data Assimilation for Undersea Weapon Acoustic Preset". MS in Physical Oceanography, June 2003 [Co-advised by Eric Gottshall (SPAWAR)]. This thesis was nominated by the Navy for the National Geospatial Academic Achievement Award in 2004.

- Chin-Lung Fang, "Predictability of Japan/East Sea (JES) System to Uncertain Initial/Lateral Boundary Conditions and Surface Winds" MS in Physical Oceanography, September 2003 [Co-advised by Steve Haeger (NAVO)].

- Albert Armstrong, "Prediction of Instantaneous Currents in San Diego Bay for Naval Applications". MS in Meteorology and Oceanography, June 2004 [Co-advised by Steve Haeger (NAVO)].

Selected CNMOC-NAVO-NPS Theses (5)

- Michael Cornelius, "Effect of a Suspended Sediment Layer on Acoustic Imagery", MS in Meteorology and Oceanography, June 2004 [Co-advised by Mel Wagstaff (NAVO)].

- Steven Mancini, "Sensitivity of Satellite Data Assimilation on Naval ASW Weapon System". MS in Meteorology and Oceanography, September 2004 [Co-advised by Charlie Barron (NRL)].

- Kleanthis Kyriadis, "Prediction of Instantaneous Currents for Mine Countermeasure ". MS in Physical and Oceanography, June 2005 [Co-advised by Steve Haeger (NAVO)].

- Patrice Pauly, "San Andrew Bay Prediction System for MIW Exercises" MS in Physical and Oceanography, June 2005 [Co-advised by Steve Haeger (NAVO)].

Selected CNMOC-NAVO-NPS Theses (6)

- Guillermo Amezaga, "Impact of GFO satellite and ocean nowcast/forecast systems for MIW and ASW." MS in Meteorology and Oceanography, March 2006 [Co-advised by Eric Gottshall (ONR)].

- Greg Ray, "Bomb strike experiment for mine countermeasure." MS in Meteorology and Oceanography, March 2006 [Co-advised by Peter Fleischer (NAVO)].

- Charles Allen, "Mine drop experiments with operational mine shapes". MS in Meteorology and Oceanography, March 2006 [Co-advised by Peter Fleischer (NAVO)].

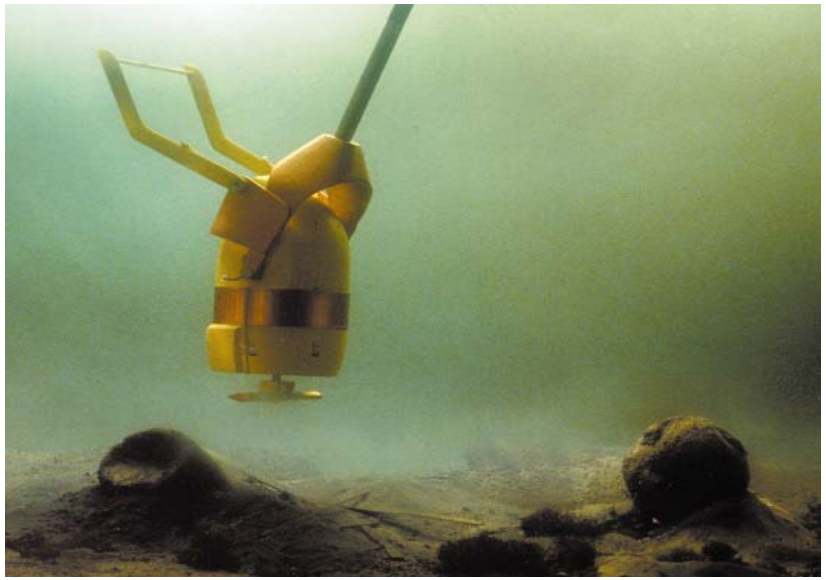
- Chung-Ping Hsieh, "Effect of internal solitons on MIW in the Philippine Sea near Taiwan." MS in Undersea Warfare, December 2006 [Co-advised by Melvin Wagstaff (NAVO)].

Thesis Topics

- Magnetic Sweep Performance Topography
- Optical Performance Topography
- Acoustic Mine Detection: Effect of Internal Waves on ASW/MIW
- Bomb Strike for Mine Clearance (STRIKE35)

(1) Mine Acoustic Detection

Mine Acoustic Detection



Brief Description

- **Ocean environmental modeling and data analysis for MIW.**
- **Establishment of mine impact burial data base**
- **Core dynamic impact burial model development and verification**
- **Mine drop experiments with various shapes**
- **Ensemble impact burial prediction model development**
- **Interfaces to other modeling components such as environmental, scour, liquifaction, and expert system**

Theses

LCDR C. Cintron, Environmental impact on mine hunting in the Yellow Sea using the CASS/GRAB model, MS in Physical Oceanography, 2001.

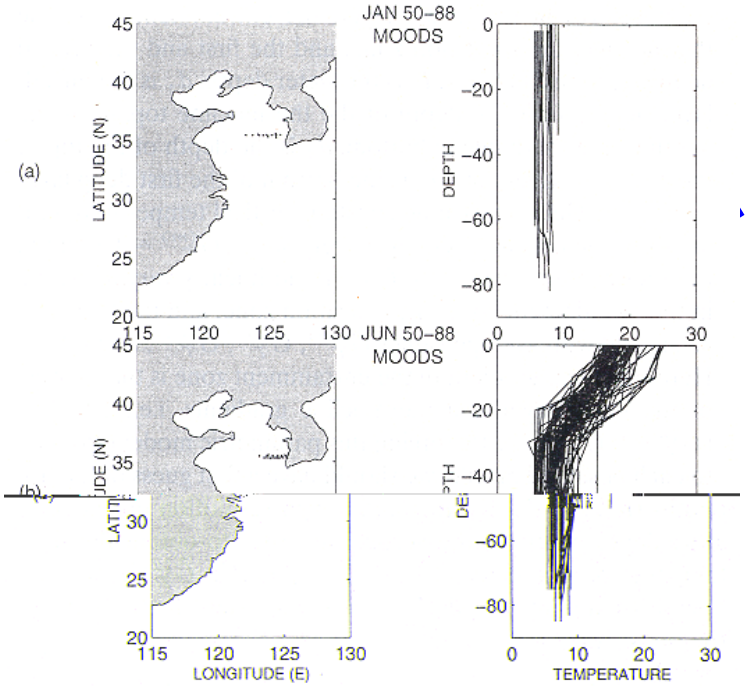
LCDR N. Vares, Range dependent mine detection using CASS-RAB, MS in PO, 2002.

LT Al Armstrong, Prediction of instantaneous currents in San Diego Bay for Naval applications, MS in METOC, 2004.

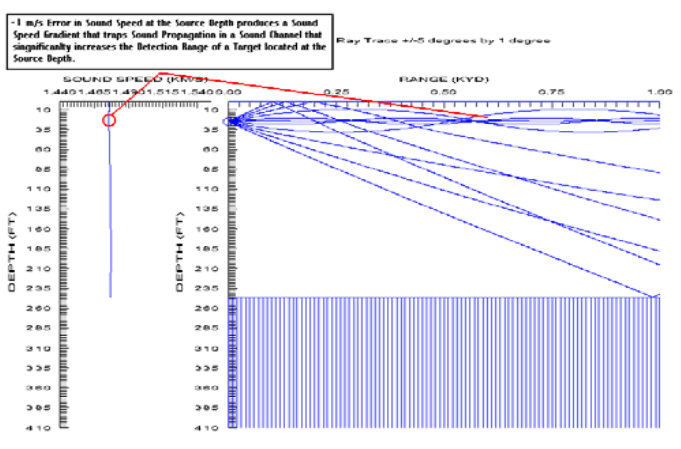
LT M. Cornelius, Effect of Suspended Acoustic Layer on Acoustic Imagery, MS in METOC, 2004.

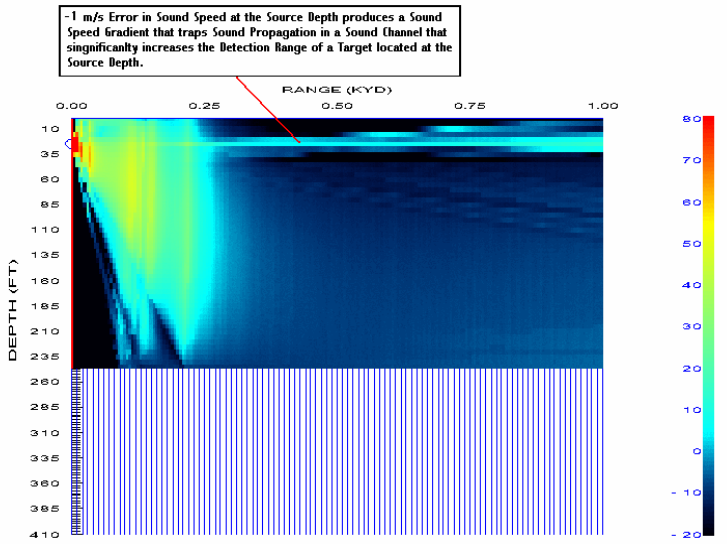
Environmental Uncertainty on Acoustic Detection

LT Cintron's Thesis



Naval Oceanographic Office's MOODS (Environmental) Data

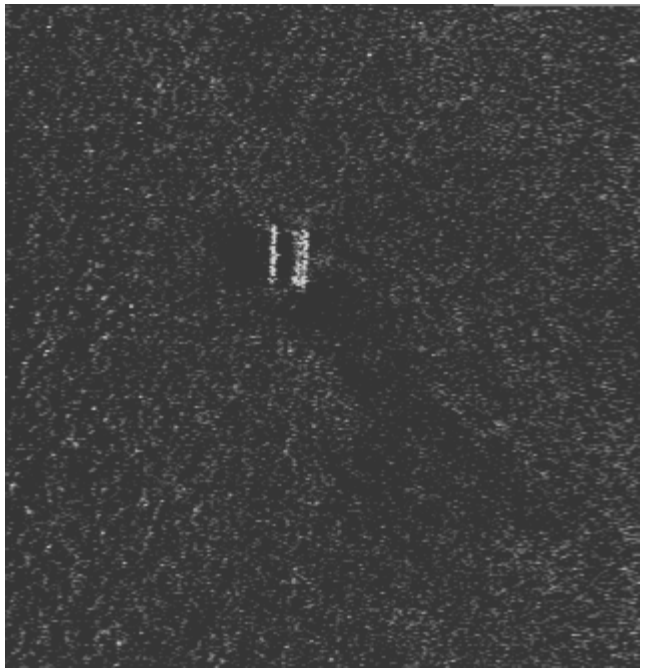


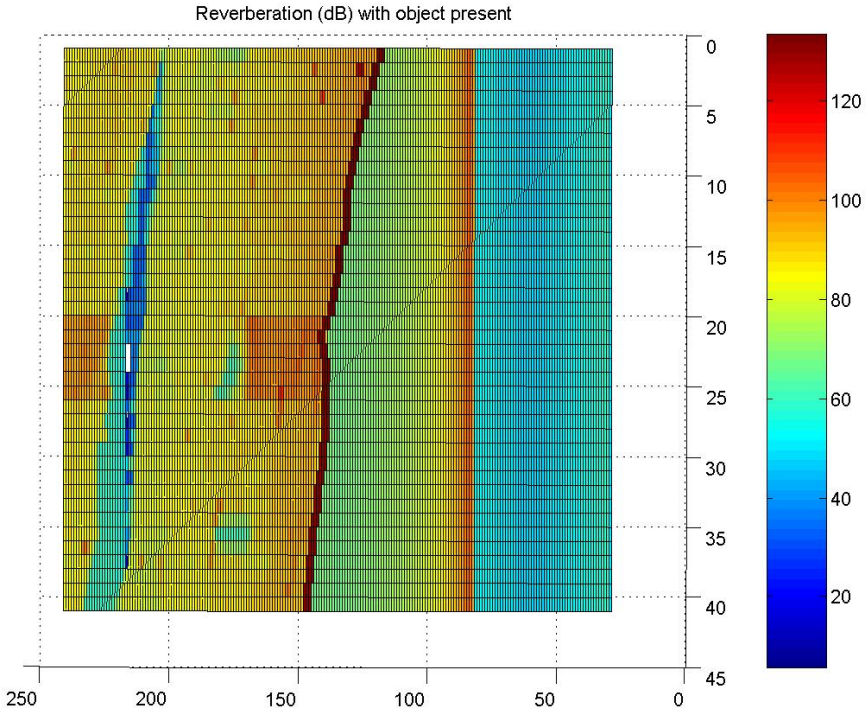


1 m/s error in sound speed enhances acoustic transmission

Buried Object Detection Using Volume Reverberation

LT Mike Cornelius' Thesis. June 2004.



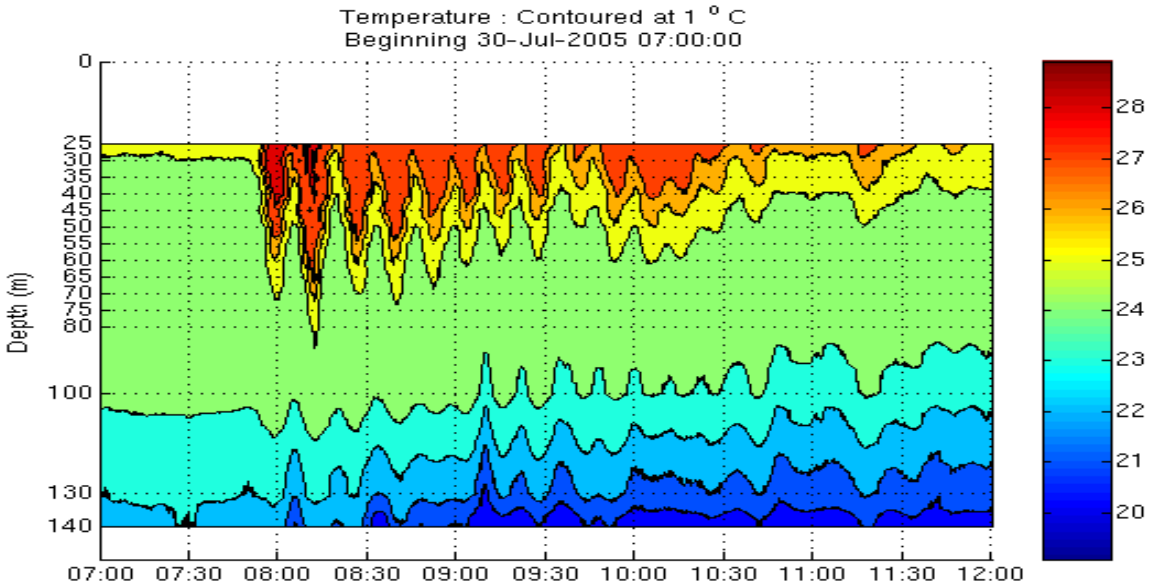


Sidescan Sonar Image

CASS/GRAB Model:
Volume Reverberation

New Problem:

What is the Effect of the Internal Solitary Waves on Mine Detection?



Temperature field in the

Philippine Sea

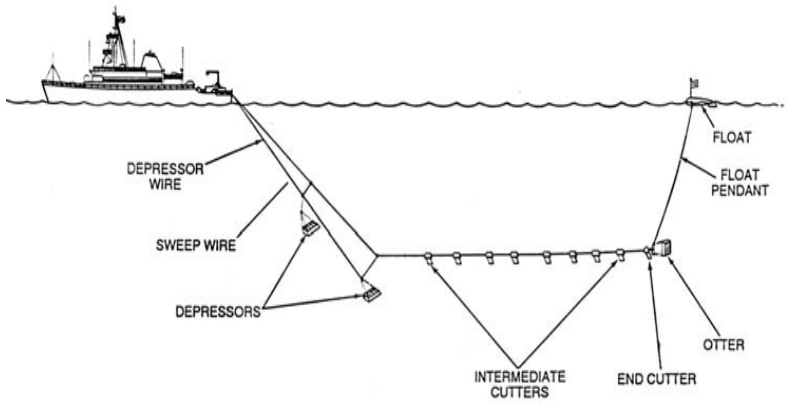
From
NAVO CMB Thermistors

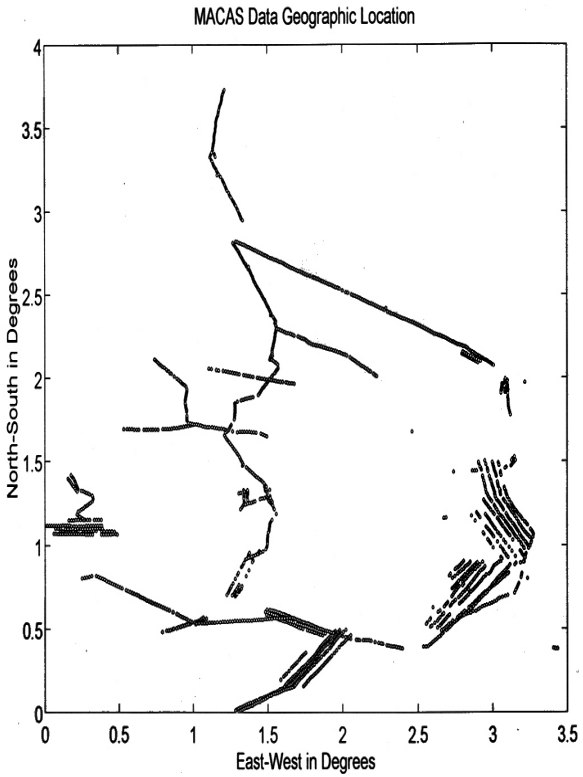
(2) Magnetic Sweep Performance Topography

Environmental Uncertainty on Magnetic Mine Sweeping

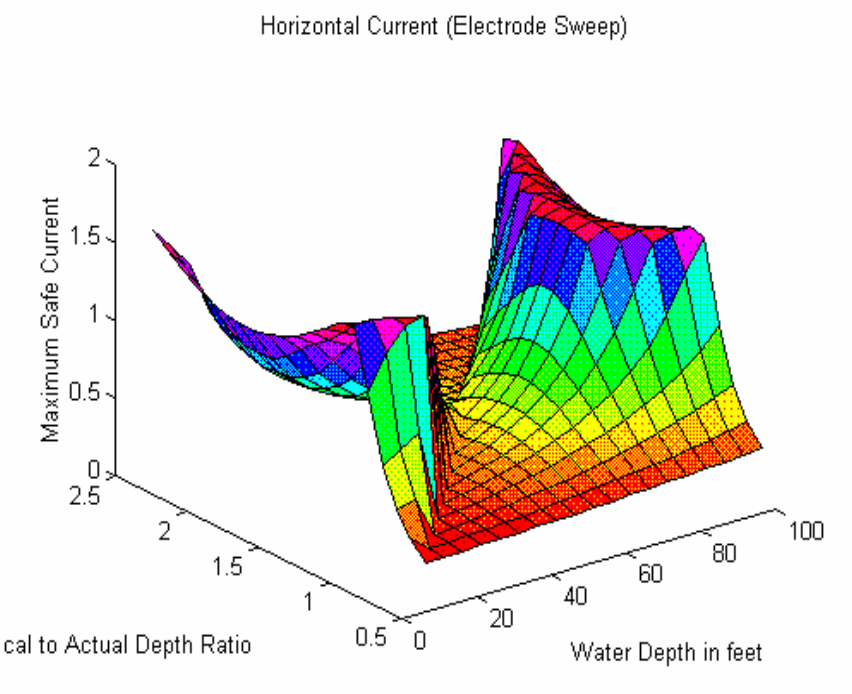
CDR Gottshall's Thesis

Mine Sweeping





Naval Oceanographic Office's
MACAS (Environmental) Data



Notice that safe current levels calculated at 60-100 ft depths
are unsafe at some shallower depths, but safe again at depths less than 30ft
for reasonable ED/AD values.

New Problems

- What is the connection of ED/AD ratio and q-values to the n-layer magnetic model?

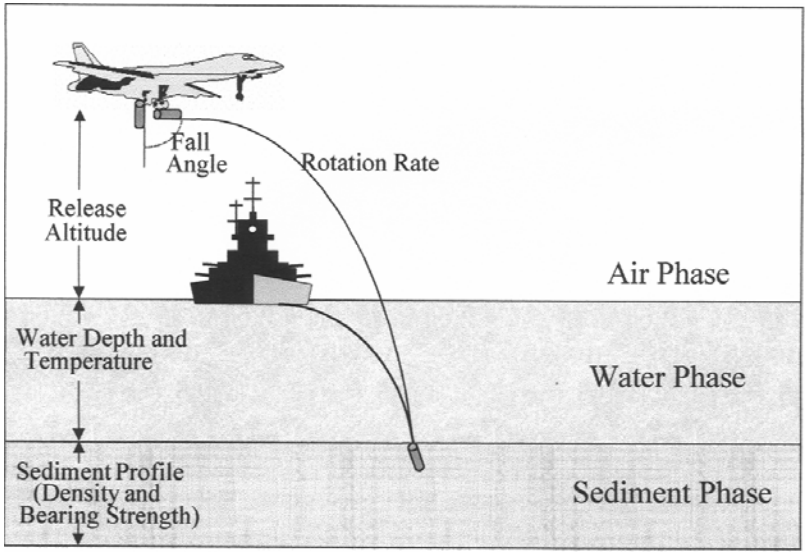
(3) Optical Performance Topography

- To provide the warfighter the planning tools he needs, an optical topography will need to be produced for an operational area that will indicate where the optical assets will be effective over the entire operational area and for what period of time.

(4) Mine Burial Prediction and Bomb Strike for Mine Countermeasure

MIW

3D Mine Impact Burial Prediction Model (IMPACT35)



Brief Description

Development of Navy's operational model (IMPACT35) for predicting trajectory and orientation of various mines in air, water, and sediment columns

- **Establishment of mine impact burial data base**
- **Core dynamic impact burial model development and verification**
- **Mine drop experiments with various shapes**
- **Ensemble impact burial prediction model development**
- **Interfaces to other modeling components such as environmental, scour, liquifaction, and expert system**

NPS Theses

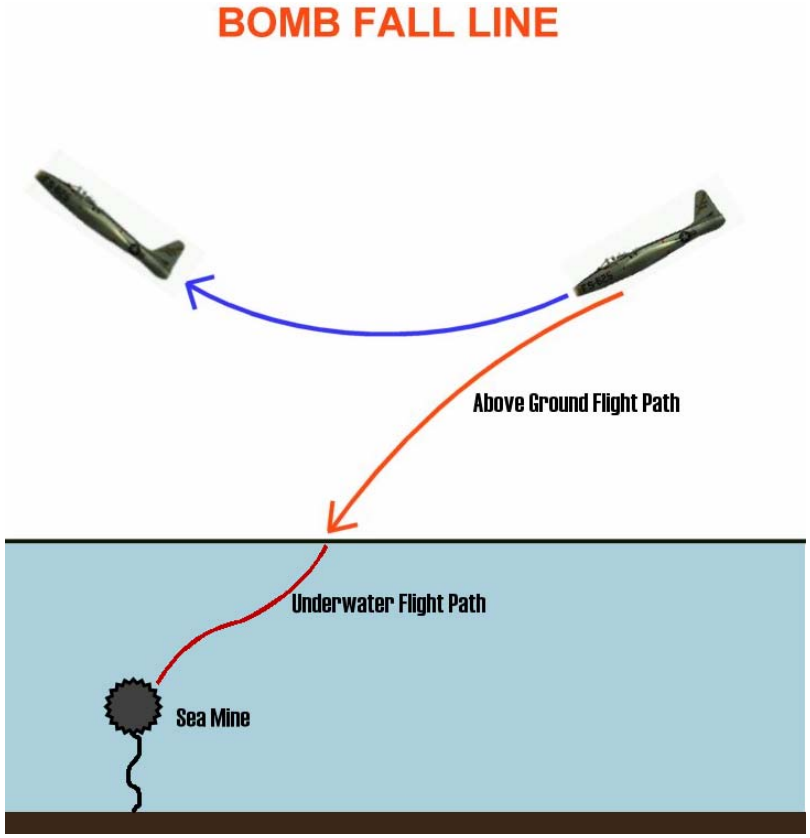
LCDR V. Taber, "Environmental sensitivity study on mine impact burial prediction model", MS in METOC, 1999.

LCDR T. Smith, "Validation of the mine impact burial model using experimental data", MS in METOC, 2000.

LCDR A. Gilles, "Mine Drop Experiment (MIDEX)," MS in METOC, 2001.

LCDR A. Evans, "Hyrdodynamics of mine impact burial", MS in METOC, 2002.

Bomb Strike for Mine Clearance (STRIKE35)

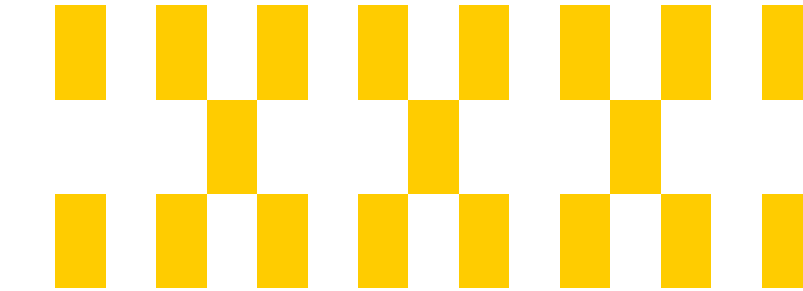


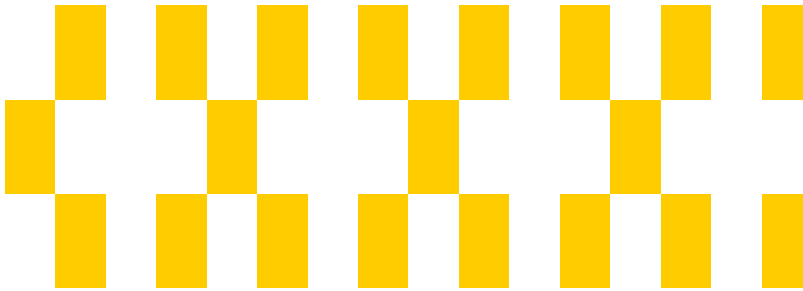
Brief Description

- **Development of Navy's operational model (STRIKE35) for predicting bomb trajectory in air, water, and sediment columns.**
- **Development of bomb-strike prediction model for bomb with a tangent Ogive nose**
- **Core dynamic model development and verification**
- **Full and reduced size bomb striking exercises**
- **Ensemble modeling development**
- **Interfaces to other modeling**

Thesis Students

LT, G. Ray, Bomb strike experiment for mine clearance, MS in METOC, 2006.





Research Objectives

MIDEX II (LT Charles Allen's Thesis, FY06)
Increase the operational effectiveness of IMPACT35 through the study and characterization of real-world naval mines.

Bomb Strike Experiment (LT Greg Ray's Thesis,FY06)

Improve warhead lethality for use in quick, precise and accurate strikes on known enemy naval minefields in the littoral combat environment.

Conclusions

- CNMOC-NAVO-NPS Thesis Program is an Optimal Program for CNMOC, METOC Officers, and NPS.